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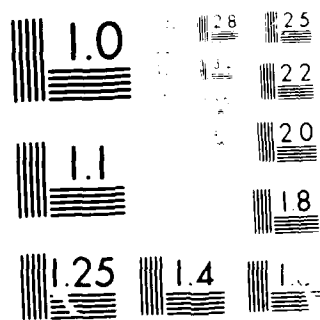
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→ Near-infrared observations have been obtained for a large sample of dwarf irregular galaxies, dwarf elliptical and blue compact dwarf galaxies. Near-infrared photometry was obtained for radio sources discovered in a deep VLA radio survey. Near-infrared observations were also obtained for the first brightest galaxy in a sample of nearby clusters. A large redshift survey, using the 21-cm hydrogen line, of dwarf galaxies in the northern hemisphere has been completed. Work has been done to understand the stellar populations and star formation are presently occurring.?

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FINAL TECHNICAL REPORT ON AFOSR GRANT NO. AFOSR-85-0125 on

"Infrared Astronomy at Extremely Faint Light Levels in Support
of the LAIRTS Program"

Period: February 1, 1985 to September 30, 1987

Trinh X. Thuan, Astronomy Department, University of Virginia

I. Publications

I list first the publications that have resulted from the grant and acknowledge its support.

1. Near-Infrared Photometry and Stellar Populations in Dwarf Elliptical and Irregular Galaxies (T. X. Thuan), Ap. J., 299, 881-895 (1985).
2. IC 3475: A Stripped Dwarf Galaxy in the Virgo Cluster (L. Vigroux, T. X. Thuan, J. P. Vader and M. Lachieze-Rey), A. J., 91, 70-75 (1986).
3. The Morphology and Structure of Blue Compact Dwarf Galaxies from CCD Observations (H. H. Loose and T. X. Thuan) in Proceedings of the Workshop on Star Forming Dwarf Galaxies and Related Objects, ed. D. Kunth, T. X. Thuan and T. T. Van (1986).
4. The Young Stellar Populations in Blue Compact Dwarf Galaxies: Spectral Synthesis of Ultraviolet Spectra, (T. X. Thuan) in Proceedings of the Workshop on Star Forming Dwarf Galaxies and Related Objects, ed. D. Kunth, T. X. Thuan and T. T. Van (1986).
5. Surface Brightness and Color Distributions in Blue Compact Dwarf Galaxies, I. Haro 2 (H. H. Loose and T. X. Thuan), Ap. J., 309, 59-69 (1986).
6. Blue Compact Dwarfs: Extreme Dwarf Irregular Galaxies (T. X. Thuan), in Proceedings of the Santa Cruz Workshop on "Nearly Normal Galaxies," ed. S. M. Faber (1987), 67-75.
7. The Spatial Distribution of Dwarf Galaxies in the CFA Slice of the Universe (T. X. Thuan, J. R. Gott and S. E. Schneider), Ap. J. (Letters), 315, L93-L97 (1987).
8. Spectral Synthesis in the Ultraviolet. I. Stellar Library (M. N. Fanelli, R. W. O'Connell and T. X. Thuan), Ap. J., 321, 768-779 (1987).
9. Near-Infrared Observations of Sub-mJy Radio Sources: Evidence for a Population of Starburst Galaxies at Intermediate Redshifts (T. X. Thuan and J. J. Condon), Ap. J. (Letters), 322, L9-L13 (1987).
10. Starbursts in Blue Compact Dwarf Galaxies (T. X. Thuan) in Proceedings of the Moriond Workshop on Starbursts and Galaxy Evolution (1987), ed. T. X. Thuan, T. Montmerle and T. T. Van (Editions Frontieres: Paris).

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11. H α Fabry-Perot Interferometric Observations of Blue Compact Dwarf Galaxies (T. X. Thuan, T. B. Williams and E. Malumuth) in Proceedings of the Moriond Workshop on Starbursts and Galaxy Evolution (1987), ed. T. X. Thuan, T. Montmerle and T. T. Van (Editions Frontieres: Paris).
12. Sub-mJy Radio Sources: A Population of Starburst Galaxies at Intermediate Redshifts (T. X. Thuan) in Proceedings of the IAP Workshop on Primeval and High-Redshift Objects (June 29 - July 3, 1987), eds. J. Bergeron, D. Kunth, and B. Rocca Volmerange (Editions Frontieres: Paris).

II. Books

During this period, I co-edited 2 books.

1. Star Forming Dwarf Galaxies and Related Objects (1986), Proceedings of a Workshop held in Paris July 1-3, 1985, ed. D. Kunth, T. X. Thuan, and T. T. Van, Editions Frontieres (Paris).
2. Starbursts and Galaxy Evolution (1987), Proceedings of the March 8-15, 1987 Moriond Astrophysics Meeting, eds. T. X. Thuan, T. Montmerle and T. T. Van, Editions Frontieres (Paris).

III. Highlights of Research

Besides the Principal Investigator, the personnel involved in the research work and supported by the grant was:

1. Dr. Stephen E. Schneider (Ph. D. Cornell University 1985) Post-doctoral Fellow.
2. Mr. Michael N. Fanelli, graduate student.

A. Near-Infrared Observations

Near-infrared J(1.2 μ), H(1.6 μ) and K(2.2 μ) observations have been obtained for a large (a total of ~ 45 objects) sample of dwarf irregular (dI) galaxies, dwarf elliptical (dE) and blue compact dwarf (BCD) galaxies.

BCDs and dIs span the same range of infrared colors, implying that they are the same type of galaxies, differing only by their present star formation rate. The infrared colors imply a metallicity range for BCDs and dIs between 1/30 and 1/3 of the sun's metallicity, while the near-IR colors of the dEs (in the Virgo cluster of galaxies) imply a metallicity range between the sun's metallicity and 1/3 of its value. dIs and dEs have thus mutually exclusive metallicity ranges, and the idea of making dEs by stripping dIs appears to be in difficulty. The work is described in publication 1.

Near-infrared JHK photometry was obtained for 32 radio sources discovered in a deep VLA radio survey having fluxes $\sim 10,000$ times smaller than those of 3C radio sources. Combining these measurements with optical photometry and spectral evolution models, we conclude that the sources responsible for the upturn in the radio source counts at sub-mJy levels represent a large starburst galaxy population with $-23 < M < -20$ and with redshifts between ~ 0.05 and ~ 0.6 .

The work is described in publications 9 and 12.

Near-infrared JHK observations were also obtained for the first brightest galaxy in a complete sample of ~ 106 rich nearby Abell clusters. A paper is in preparation which will study the stellar populations in these first brightest galaxies, as a function of the cluster environment.

B. Other Work

A large redshift survey, using the 21-cm hydrogen line, of ~ 2000 dwarf galaxies in the northern hemisphere has been completed. The redshift catalogue is being readied for publication. The data will be used to study the large-scale clustering of dwarf galaxies in the universe. In particular, one question of great interest is whether dwarf galaxies fill in the large voids seen in the bright galaxy distribution. Preliminary work (publication 7) suggests that they do not, and that result puts strong constraint on possible galaxy formation theories.

Much work has also been done to understand the stellar populations and star formation history of blue compact dwarf (BCD) galaxies where intense bursts of star formation are presently occurring. The work is based on deep CCD pictures and ultraviolet and optical spectrophotometry which have been obtained for a large sample of BCDs. It is described in publications 3, 4, 5, 6, 8, 10 and 11.



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